

## GROWTH AND DECAY

- An experimental population of fruit flies increases according to the law of exponential growth. There were 100 flies after the second day of the experiment and 300 flies after the fourth day. Approximately how many flies were in the original population?

- The number of bacteria in a culture is increasing according to the law of exponential growth. There are

125 bacteria in the culture after 2 hours and 350 bacteria after 4 hours.

(a) Find the initial population.

(b) Write an exponential growth model for the bacteria population. Let  $t$  represent time in hours.

(c) Use the model to determine the number of bacteria after 8 hours.

(d) After how many hours will the bacteria count be 25,000?

- A certain radioactive material is known to decay at a rate proportional to the amount

present. Initially, 100 grams of the substance are present, but after 50 years the mass decays to 75 grams. Find an expression for the mass of the material at any time. What is the half-life of the material?

- A cypress beam found in the tomb of Sneferu in Egypt contained 55% of the radioactive carbon-14 that is found in living cypress wood. Estimate the age of the tomb. (half life of carbon 14 approx. 5730 years)

- The U.S. government has dumped roughly 100,000 barrels

of radioactive waste into the Atlantic and Pacific oceans. The waste is mixed with concrete and encased in steel drums. The drums will eventually rust, and seawater will gradually leach the radioactive material from the concrete and diffuse it throughout the ocean. It is assumed that the leached radioactive material will be so diluted that no environmental damage will result. However, scientists have discovered that one of the pollutants, americium 241, is sticking to the ocean floor near the drums. Given that americium 241 has a half-life of 258 years, how

long will it take for the americium 241 to be reduced to 5% of its present amount?

- In 1964, Soviet scientists made a new element with atomic number 104, called El04, by bombarding plutonium with neon ions. The half-life of this new element is 0.15 second, and it was produced at a rate of  $2 \times 10^{-5}$  micrograms per second. Assuming that none was present initially, how much El04 is present after  $t$  seconds?

- The Disappearing Mothball: The rate at which a mothball evaporates from a solid to a gaseous state is proportional

to the surface area of the mothball. Suppose a mothball has been observed to have a radius of 0.5 inch and after 6 months a radius of 0.25 inch.

(a) Express the radius of the mothball as a function of time.

(b) When will the mothball disappear completely?